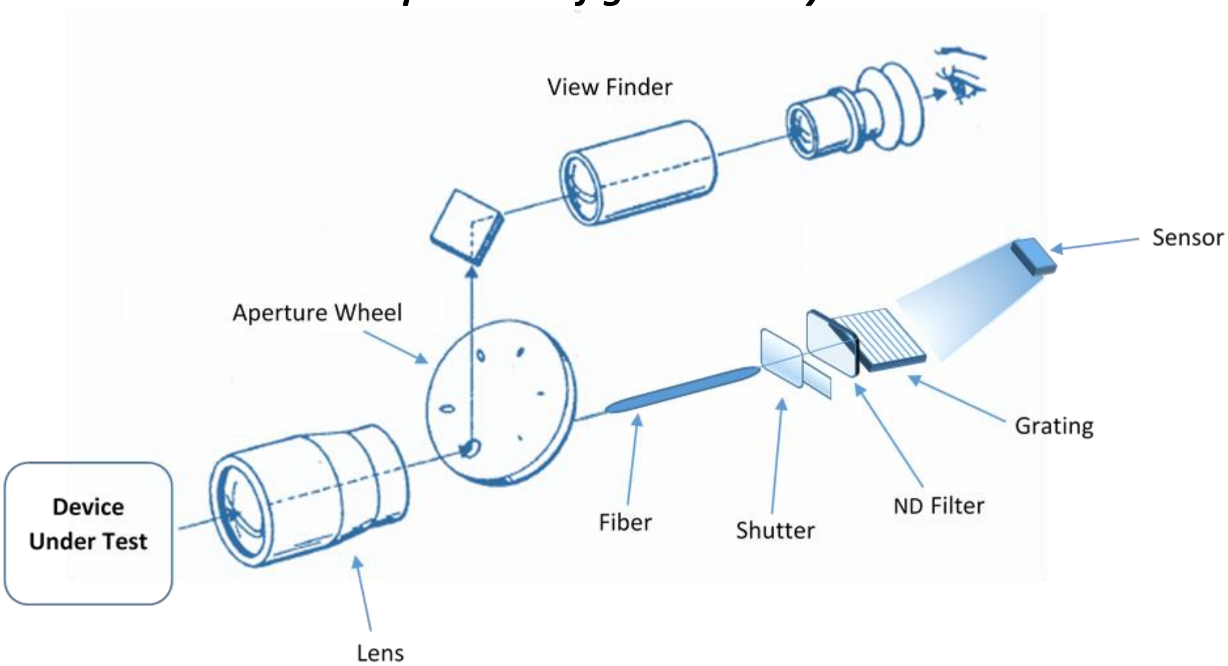
Alignment of Measuring Aperture on the Target

Luminance measurements of self-luminous or reflective sources are among the most common type made with photometers. In this instance, a spot photometer or spot meter is used. This type of photometer incorporates light collecting optics, usually a telephoto or microscope objective lens, and an aperture (hole) that defines the measuring field. The objective lens focuses the light on the measuring aperture, and the light is then relayed to the detector through the photopic filter. The sample is imaged on the surface of the detector. The operator sees an image of the measuring aperture superimposed on the target using the photometer's viewing system.

Optical Configuration Layout



Block diagram of a Pritchard spot photometer. This type of system ensures that there is always perfect alignment of the measuring aperture, since the alignment aperture and measuring aperture are the same component.

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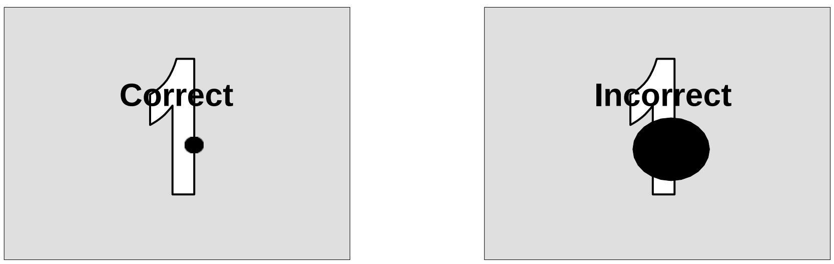
When making luminance (or radiance) measurements with a spot photometer (or radiometer), it is important to properly align the measuring aperture on the target to be measured. If the measuring aperture is larger than the target, the ratio result will be low. The lighted area will be lower than the area of the aperture.



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The area error can be calculated with the formula: $Ca = Ma / Sa$

Ca is the area correction factor, *Ma* is the area of the measuring aperture and *Sa* is the area of the sample falling within the measuring aperture. When the area of the sample is larger than the area of the measuring aperture, Ca is always 1.00.

Make sure the measuring aperture falls within the lit area of the target. Failure to adhere to this step will result in erroneous readings. If possible, or unless otherwise specified, we recommend that the diameter of the aperture cover 50% to 80% of the smallest dimension of the object. Also consider that every sample and every situation will be different. Therefore, additional measurement should be taken to determine the best measurement setup.

Reliability Testing verses Repeatability Testing

The concept of “reliability testing” is often confused with “repeatability testing.” If repeated measurements are taken after setting up an instrument correctly, this is repeatability testing. Repeatability testing is very important because it establishes the ability of the device under test to repeat results in a short-term measurement cycle.

Reliability Testing tests the fundamental accuracy and repeatability of MULTIPLE SET-UP procedures. This implies a complete mount, warm-up cycle, short-term measurement (repeatability test), turn off, and dismount. By definition, the Reliability Measure Error must

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always be equal or greater than the Repeatability Measurement Error. This is especially true for a population of instruments.

Data Requirements

Measure the reference source with the device under test. The number of repeat measurements for this test should be greater than 10. The physical amount of time to perform the multiple measurements with a standard reference should be less than a minute. The mean and standard deviation should be calculated on the Tristimulus, XY&Z data. Do not use chromaticity data (Y x y) for this testing, because the distribution of the chromaticity is never Gaussian. So typical statistical measurements such as T-tests of means and F-Tests are not suitable. This is the short-term repeatability test for a single reliability test. In general, these values will be extremely stable and may often return a negligible standard deviation.

The system is returned to the powered down state, dismounted from the fixture, and then remounted, repowered, and the next Repeatability test is run. This process should occur for no less than 7 cycles. The data samples for each of the Repeatability Tests are used to form the final data set for the Reliability Test. The mean and standard deviation is calculated for the entire set of data. This becomes the basis for the statistical description of the reference test station. If two instruments are used, the pooled data from both instruments is used to calculate the Reliability Measurement Uncertainty. At the end of this test protocol, there is a measure of total test protocol error. This measure represents the limits of the measurement system. The average result of the process represents the characterization value. Any value that falls within the limits of the Reliability Measurement Uncertainty around the mean are effectively "in control".